

In order to solve the above-mentioned problem, according to a first aspect of the present invention, there is provided a printer, wherein some of the plurality of nozzles allocated to one head chip are placed so as to be partly overlapped with a plurality of nozzles allocated to the adjacent head chips at the adjacent head chips, as viewed from the direction of feeding a print object, in order for ink droplets to be adhered to almost the same point.

Please replace the second and third paragraphs on page 15 with the following substituted paragraphs:

In the line printer 11, the paper 14, which is switched by the feed direction in such a manner, is guided by the spurring roller 18 and so on such that the paper traverses over the paper tray 13. And as shown in the arrow C, the paper is ejected from the outlet placed at the front side. In the line printer 11, between the spurring roller 18 and the outlet, as shown by the arrow D, the head cartridge 20 is placed in an exchangeable way.

The head cartridge 20 comprises the head 21 placed beneath the holder 22 having the predetermined form, in which respective line heads yellow, magenta, cyan and black, are placed. In the holder 22, the ink cartridges Y, M, C and B are to be placed respectively. Thus, the line printer 11 can print an image and so on by ejecting each color ink to be adhered onto the paper 14 from the corresponding line head.

Please replace the second paragraph on page 16 with the following substituted paragraph:

The head 21 comprises the head chips 25 placed in 4 lines, each of which corresponds to printing yellow, magenta, cyan and black colors, and which are placed across the paper 14 to form a line head. Thereafter, to the head 21, the metallic plate 26 is attached, which is fabricated to have a corrugated surface on the side of the head chips 25, and then each of the head chip 25 is connected.

Please replace the last paragraph on page 18 with the following substituted paragraph:

In the head chips 25 as described above, the shifted position of the nozzles 31 is used effectively to drive the grouped heaters 28 sequentially. Moreover, when nozzles 31 are shifted in such a manner, for the head chips 25 placed on both the upper side and lower side of the ink-flow path 33, heaters 28 are driven in the inverse direction for the driving signal. In this embodiment, for each head chip 25, the driving circuit is configured such that the driving sequence can be switched in accordance with the above-mentioned driving sequence.

Please replace the second paragraph on page 19 with the following substituted paragraph:

As shown in Figs. 5 to 11, in this embodiment, seven nozzles 31 forming each group are controlled sequentially in respective phases, from the phase 1 through phase 7, starting from the nozzle 31 at the feeding side of the paper 14. In Figs. 5 to 11, the number corresponding to each phase is given to the relevant nozzle. As shown in Fig. 5, when the paper 14 is fed, in the start phase 1, the nozzle 1, which is the nearest to the paper feeding side, is driven to print the dot D1. Then the paper 14 is fed as much as for printing by the subsequent nozzle 2 (Fig. 6), the subsequent nozzle 2 is driven to print the dot D2. Thus, by driving the nozzles 3 to 7 in synchronization with feeding the paper, the dots are printed sequentially (in Figs. 7 to 11). As a result, in this embodiment, the nozzles 31 in a group are driven such that they are driven with some time difference. Also, the corresponding nozzles 31 of each group are to be driven concurrently.

Please replace the second and third paragraphs on page 20 with the following substituted paragraphs:

In the head 21, driven in this way (Fig. 1), some of the nozzles allocated to one head chip are placed so as to be partly overlapped with a plurality of nozzles allocated to adjacent head chips as viewed from the direction of feeding a print object in order for the ink droplets

to be adhered to almost the same point. By this, in the line printer 11, for the overlapped area of printing dots by adjacent head chips by these nozzles, the dots printed by these adjacent head chips are mixed, so that irregular characteristics of adjacent chips are unnoticeable by mixture of these dots, thereby making it possible to prevent quality deterioration of print result.

Fig. 12 is a block diagram of the line printer. In the printer 11, the interface (I/F) 43 receives control commands, text data and image data from the host system, personal computer 42, and sends them to the Central Processing Unit (CPU) 44. The console 45 is a pressing-button console attached to the line printer 11. In the printer 11, by operating the console 45, instructions can be accepted for example, setting various printing positions, testing print and so on. The display unit 46 comprises the liquid-crystal panel attached to the console panel, and, in response to the operations of the console 45, it can be used to display menus for various settings and the detailed information.

Please replace the last paragraph on page 23 with the following substituted paragraph:

In the head 21, on the semiconductor substrate 27, the heaters 28 are placed sequentially, and also on the semiconductor substrate 27, the drive circuits 29 for the heaters 28 are placed to form the head chip 25. The array of the head chips 25 forms the head 21 (Fig. 3).

Please replace the last and second to last paragraphs on page 26 with the following substituted paragraphs:

However, in this embodiment, the nozzles 31 for a plurality of head chips are made on one piece of the nozzle plate 23, on which a plurality of head chips 25 are placed such that the ink beds 30 and the heater elements 28 are built in (Figs. 3 and 4). Thus, even if the head chips 25 are misplaced, it is possible to prevent misplacement of the nozzles 31 that cause the

positioning errors of dots. Specifically, in the processing of making the nozzle 31 on the nozzle plate 23 made of one thin plate, photolithography technology can be applied, thereby making it possible to make the nozzles with a very high precision of 1 μm or less. Thus, it is possible to effectively prevent deterioration of print quality due to misplacement of the head chips 25.

More specifically, there is a case, as shown in Fig. 15 where the head chips are misplaced in the perpendicular direction of alignment of heads when comparing with the case of placing the head chips 25 correctly as shown in Fig. 14. Also, as shown in Fig. 16, there is a case that the misplacement is in the direction of paper feed, and that alignment in inclining as shown in Fig. 17. Even in these misplaced cases, since the nozzle 31 is correctly positioned, the misplaced head chips 25 can make a dot at the right position determined by the positions of the nozzles. Therefore, it is possible to prevent deterioration of print quality due to misplacement of dots in the same color.

Please replace the last paragraph on page 28 with the following substituted paragraph:

The following is some additional description on the above-mentioned case where a head chip having a print width is used to form a printer head. The above-mentioned head chip is created by cutting a disc-shaped silicon substrate. When creating the longer head chip having a print width, the fewer the number of head chips can be taken from the silicon substrate lowers the yield rate. Furthermore, when creating the longer head having a print width, it is necessary to incorporate the larger number of elements such as heaters and so on into one head chip, thereby lowering the total yield rate. Besides, wiring pattern to be formed on the head chip will be longer, thereby giving more influence on the head chip by the resistance value of the wiring pattern. Therefore, for a head chip, the above-mentioned head chip 25 is preferable to a long head chip having a print width.

Please replace the paragraph on page 29 starting on line 5 with the following substituted paragraph:

In the above configuration, some of the nozzles allocated to one head chip are placed so as to be partly overlapped with a plurality of nozzles of adjacent head chips as viewed from the direction of feeding a print object in order for ink droplets to be adhered to almost the same point, thereby making it possible to prevent quality deterioration of print result caused by irregular characteristics of adjacent chips.